EVALUATION OF CENTRALIZED WWTP AND THE NEED OF COMMUNAL WWTP IN SUPPORTING COMMUNITY-BASED SANITATION IN INDONESIA

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Abstract

Millennium Development Goals (MDG's) to increase access to clean water require major changes in the water and sanitation sector. MDG's target in 2015 was 50% of the population should be accessible sanitation. Centralized Wastewater Treatment Plant (WWTP) in Jakarta, Bandung and Cirebon were built as an effort to support the city's sanitation. The performance efficiency of WWTP reached 80% and the treated wastewater is accordance with quality standard. But the WWTP in the three cities only serve <20% of the population. Up until now, the greywater from residential, has not optimally treated and into receiving natural water system causing pollution. Domestic wastewater pollution contribution by 60% in the receiving natural water system. Community already aware of the need to treat domestic wastewater as an effort to maintain environmental sanitation. Community expects a communal wastewater treatment. Communal WWTP base community must be built to anwers the sanitation problem in urban area. Positive perception from community could manage of waste water at the communal scale.

Keywords: Centralized WWTP, Communal WWTP, community, sanitation

Introduction

In urban area, waste water is a potential water pollutant. Level of pollution in natural water system is increasing every year with the increase of population and human activities. Up until now, waste water, primarily from settlements, was directly discharged into the drainage system then flow into the natural water system. The entry of untreated wastewater cause pollution in waters. Department of Public Works of the Republic of Indonesia, Directorate General of Water Resources, 2006 said, in Indonesia, domestic wastewater contribute 60% pollution in the receiving natural water system. 50% of river water were monitored in 30 provinces showed the parameters of water quality such as DO, BOD, COD, fecal coli and total coliform not in accordance with the quality standard for Class I according to the Goverment Regulation No. 82 of 2001 on Water Quality Management and Water Pollution Control, the water allocation can be used for drinking water and raw water or other uses that require water quality is the same as the utility.

Centralized Wastewater Treatment Plant (WWTP) was built as an effort to support the city's sanitation. The WWTP to improve public health through pollution wastewater control. In common with wastewater treatment services, are expected to reduce the pollution of groundwater and surface water, improve the environmental quality, improve the health of urban communities and to achieve "the Millennium Development Goals", in particular on aspects of sanitation. Centralized WWTP has been built in 12 cities in Indonesia (Medan, Jakarta, Bandung, Cirebon, Yogyakarta, Surakarta, Denpasar, Banjarmasin, Balikpapan, Tangerang, Batam dan Menado). The centalized WWTP only serve 10% of the population (Ministry of Public Works of the Republic of Indonesia, Directorate General of Human Settlements, 2012). This condition is clearly inadequate. The centralized WWTP up until now has not answered the needs of urban sanitation. The main problem in setting up city-scale WWTP is required extensive land, high cost, processing operations that require energy and is operated by trained personnel. Therefore we need a communal scale WWTP to reduce the load on the urban WWTP.

Increased awareness of the impacts of pollutants on receiving natural water system, as well as the target of Millennium Development Goals (MDG's) to increase access to clean water, require major changes in water and sanitation sector. Looker (1998) in Volkman (2003) said that in two decades application of waste treatment should be implemented at low cost. The purpose of wastewater treatment with low costs is that the community can do it independently and with ecological principles.

One of the principles of ecological sanitation, utilizing the treated greywater to be used again for example of irrigation, water ponds, recharging groundwater, and so on. By managing the wastewater with a closed cycle,

waste water can be used more efficiently. Greywater management requires community involvement in the commitment and cooperation of all stakeholders. Managing greywater is a way to secure resources for the life and development of water resources in urban areas.

The purpose of the research are evaluating the performace and management pattern of WWTP in Jakarta, Bandung and Cirebon and knowing the needs of the community about sanitation in their area.

Methode

The study was conducted in 2010-2012. The study of the performance evaluation and management patterns WWTP conducted in the city of Jakarta, Bandung and Cirebon. The data obtained are primary and secondary data. The primary data taken by depth interview with managers and secondary data from a variety of information about the performance and management patterns WWTP.

Assessment of the need sanitation facilities by the local community, refer to the study by the Jakarta Environmental Management Agency, 2011. Study area covers 12 kelurahan along the Ciliwung River in Jakarta. Respondents each village consisting of 10 people of the village employee, chairman neighborhoods, caretaker of Family Welfare Empowerment, members of the Organization Council of Kelurahan and the general public. Total sample of 120 people. The questions on the questionnaire are priority needs of sanitation facilities in the region consists of an integrated waste management site, communal wastewater treatment plants, water supply systems and `.

Result and Discussion

Urban Waste Water Treatment Plant

Urban Waste Water Treatment Plant was built to support the city's sanitation. Improved public health through wastewater pollution control. Control of waste water are part of environmental management. Wastewater is discharged through the channels should be safe from environmental pollution. Description of the Urban WWTP in 3 cities: Jakarta, Bandung, and Cirebon:

1. Jakarta Wastewater Treatment Plant (PD PAL Jaya)

Jakarta Wastewater Treatment Plant (PD PAL Jaya) was established to assist and support local government public policy in order to improve the welfare of the community by providing services and sewerage collection system through piping. (USAID, 2006) said, up until now, only in Jakarta a PD organizational form is applied, separate from the Municipal Water utility. An advantage is the independency from the government and PDAM. They have their own responsibility and can work independently. Disadvantages are that they do not have the backing of local water company (PDAM).

PD PAL Jaya provide installation service connection for waste water disposal domestic wastewater and non domestic such as office buildings, storey buildings, hotels, entertainment venues, markets, schools, hospitals, apartments, industrial and so on. Treatment facility to service the region and surrounding Setiabudi-Tebet, using Setiabudi Reservoir. Setiabudi reservoir previously serves as a flood control, added functioned a domestic wastewater treatment facility/Waste Water Treatment Plant (WWTP).

Processing technology used is Aerated Lagoon using 7 aerator units which has the ability to supply oxygen 48 kg/hour/unit. Retribution regulated by the Governor of DKI Jakarta No.. 1470 of 2006 on the Tariff Adjustment Services Wastewater Disposal Services and Waste Water Pipe Connection Fees PD PAL Jaya.

2. Bojongsoang Bandung Wastewater Treatment Plant

Bojongsoang Wastewater Treatment Plant managed by PDAM Bandung stood since 1992. This installation is located in the district of Bojongsoang, Bandung regency with area 85 ha. The treatment plant has a capacity of ±243,000 m^3, can serve ±400,000 people for the service area of East Bandung, Central Bandung, and South Bandung.

Influent wastewater comes from domestic. The process used was stabilization ponds. The effluent which is in accordance with quality standards thrown into natural water system, used by the community for irrigation (agriculture and fisheries). Sludge from the anaerobic ponds are used for a variety of research and fertilizers in gardens and reforestation.

3. Cirebon Wastewater Treatment Plant

Domestic wastewater in the city of Cirebon is managed by the Cirebon Regional Water Company (PDAM). In Cirebon, there are 4 Waste Water Treatment Plant (WWTP) that WWTP Kesenden, Ade Irma, North Housing and Southern Housing. Percent of areas underserved by 15.02%. WWTP influent Kesenden from office, Ade Irma WWTP influent of the market, industry and city channels, WWTP influent North Housing (Glatik) and South (Rinjani) derived of settlement. Cirebon WWTP effluent further flowed into the Java Sea.

The performance of Urban WWTP in Jakarta, Bandung and Cirebon showed a fairly good efficiency to reduce pollutants. Pollutant parameters reduced are Total Suspended Solid (TSS), BOD, COD, ammonia, phosphates, detergent, oil and grease. Decree of the Minister of Environment No. 112 of 2003 on Domestic Wastewater Quality, the target parameters must be reduce are pH, BOD, TSS, oil and grease. The five main parameters considered representative an overview of domestic wastewater. While the research results Hendrawan (2013), other than organic matter content, generally the settlement in urban area using the materials containing organic chemicals such as disinfectants and cleaning. All of these product categories, singly or

in combination cause toxicities that are harmful to the environment. therefore the typical urban parameters and should be targeted reduction in domestic wastewater are TSS , BOD, COD, ammonia, phosphates, detergents, oil and grease, phenols and fecal coli.

The target efficiency is achieved ± 80%. Effluent is released into the receiving water body are in accordance with quality standards. Table 1 presents a summary of the performance of an urban wastewater treatment in Jakarta, Bandung and Cirebon. Up until now, the wastewater treatment plant in the three cities only can serve <20% of the population. Urban Wastewater Treatment Plant is still many obstacles and problems such as limited land in urban areas, fund and professional workers. This condition causes not all domestic wastewater processed primarily greywater.

From the public's perspective, the primary deterrent to implementation of alternative wastewater management technologies has been the fear of a life-style change. Most individuals desire wastewater management to be unobtrusive, convenient, and not to require significant maintenance efforts on their part. The newer decentralized technologies have been developed to integrate easily with traditional plumbing fixtures and do not require a significant life-style adjustment. Essentially, the core components of DWM are the same as centralized collection and treatment systems, but the applied technologies are different (Burian et al., 2000).

According to the Indonesia Ministry of Public Works (2010), waste water treatment system consists of a centralized wastewater treatment system (off-site system) and the local waste water treatment systems (on-site system). Advantages and disadvantages of the two systems as follows:

1. Centralized Wastewater Treatment Systems (Off Site System).

Centralized wastewater treatment system is a wastewater treatment system using a network of piping systems to collect and drain off waste water for r processing.

Advantages of centralized wastewater treatment systems:

a) Provide the best service;
b) Appropriate to areas with a high density;
c) The pollution of ground water and natural water system can be avoided;
d) Having a useful life longer;
e) Can accommodate all waste water

Disadvantages centralized wastewater treatment systems:

a) Investment cost, operation, and maintenance are high;
b) Using high-tech;
c) Could not be done by individual;
d) Full benefit is obtained after completion of the long-term;
e) A long time in the planning and implementation;

f) Require the management, operation, and maintenance of good

2. Communal Wastewater Treatment System (On Site System)

Communal wastewater treatment system as a system where wastewater treatment facilities is in boundary of land owned.

Advantages communal waste water treatment system:

a) Using a simple technology;
b) Require a low cost;
c) Community and every family can provide their own;
d) Operation and maintenance by the community;
e) Benefits can be perceived directly.

Disadvantages local waste water treatment system:

a) Could not be applied to any area, for example depending on the nature of the soil permeability, density, etc.;
b) Limited function of human waste effluent, wastewater does not serve the shower and the water used to wash;
c) Operation and maintenance are difficult

During its development, according to the community-based sanitation target, communal waste water treatment is not limited to process the human waste (excreta) but also developed technology to process greywater biologically. There have been many technologies developed to treat wastewater settlement greywater types. Implementation of wastewater treatment technologies must be adapted to the characteristics of wastewater and the community. Community should have a positive perception of the receiving wastewater treatment in the area. Perceptions and positive community participation supports the efforts of wastewater management in the communal level.

Table 1 Evaluation Performance of Urban WWTP in Jakarta, Bandung and Cirebon

No.	Information	Waste Water Treatment Plant		
		Jakarta WWTP	Bojongsoang Bandung WWTP	Cirebon WWTP
1	Board scope of services	3% from board of Jakarta	58 % from borad of East, Central and South Bandung	15% from borad of Cirebon
2	Underserve population	190,000 people (2 % population)	500,000 people (11% population)	80,460 people (27% population)
3	Source of waste	household, offices, buildings and hotels in surrounding areas	household, hotels, hospitals, malls, restaurants, etc	city, settlement
4	Board of WWTP	4.38 Ha	85 Ha	10.25 Ha
5	Type of processing	Aerated pond	Stabilization ponds consisting of anaerobic, facultative and maturation pond	oxidation ponds consisting of anaerobic, facultative and maturation pond
6	Parameters measured	TSS, BOD, COD, organic compound, ammonia, detergent, oil and grease	BOD, COD, ammonia, nitrite, nitrate, sulphate, phosphat, Fe, Cr, Cu, Mn, Zn, detergent and fecal coli	TSS, BOD, COD, ammonia, nitrate and phosphat
7	WWTP efficiency	80%	80%	65%
8	Type of retribution	According to Kep Gub Jakarta. No. 1470 year 2006 on the Determination of Tariff Adjustment Services Waste Disposal Water and Waste Water Pipe Connection Fees PD PAL Jaya.	According to Decree of Mayor Bandung No.194 year 2002. Included with drinking water retribution (30% added to the drinking water retribution)	No special retribution of wastewater (included in the water retribution but can not be separated)
9	Cooperation with community	Currently no	Currently no	Communities utilizing water hyacinth that grows in the oxidation pond and sold as raw material crafts
10	Outlet and the utilization of process	Flowed into Ciliwung River	Flowed into Citarum river and used for agriculture and fisheries	Flowed into Jawa Sea
11	Environmental management is conducted in WWTP area	Waste management	Greening at the WWTP site, the home nursery and fruit plants, WWTP sludge for fertilizer	Routine management of the area of WWTP

Based on survey on the three urban WWTP, some of the advantages and disadvantages of urban WWTP are listed in Table 2.

Tabel 2 Advantages and disadvantages of urban WWTP

No.	Description	Advantages	Disadvantages
1	Land	Centralized land	Require large area
2	Technology	Using the advanced technology	Operation of complex equipment
3	Labour	Technicians to operate the equipment conducted by a person skilled	Difficult operated by community
4	Utility	High utilization capability	Increase the utility related the need of land and energy
5	Removal efficiency	Removal efficiency can be set	Efficiency related with cost
6	Contaminant reduction capability	Reduce any contaminants	Mixed contaminants in sludge should be careful when used as fertilizer
7	Manager	Management conducted centrally so that more focused	Does not require the participation of the community and the lack of control function
8	Cost	Centralized cost	High cost

The Need Communal Wastewater Treatment

Decentralization wastewater treatment more flexible in the management and simpler technology. Decentralized system is not only a long-term solution for a small community, but it is more reliable and cost-effective (Massoud et al., 2009). Destination on a small scale sewage treatment and decentralization are (1) to protect public health, (2) to protect the environment from degradation or pollution, and (3) reducing processing costs because the unit was built near sources (Tchobanoglous, 1998). Small communities have limited skills in the economic and in the process waste water (Nelson & Dow, 1994 in Tchobanoglous, 1998). It is therefore needed wastewater treatment technologies inexpensive and easy to operate by the community.

The purposes of communal sanitation facility refer to the needs of community. Jakarta Environmental Management Agency's study results (2011) for the purposes of sanitation facility in 12 villages around the Ciliwung River, there are 5 kelurahan propose procurement communal wastewatert treatment plant (WWTP) are Rawajati, Kebon Manggis, Pegangsaan, Kenari, and Kwitang (Figure 1) . The study shown that the growth of public awareness for treating waste water in an effort to keep the environment clean.

The obligation to treat domestic wastewater contained in the Decree of the Minister of Environment No. 112 of 2003 on Domestic Wastewater

Quality. Article 8 of Decree states that any person in charge of the business and or settlement activities (real estate), restaurant, offices, commercial and apartments are required to treat domestic wastewater. Article 9 (1) of domestic wastewater treatment can be done together (collective) through an integrated domestic wastewater treatment.

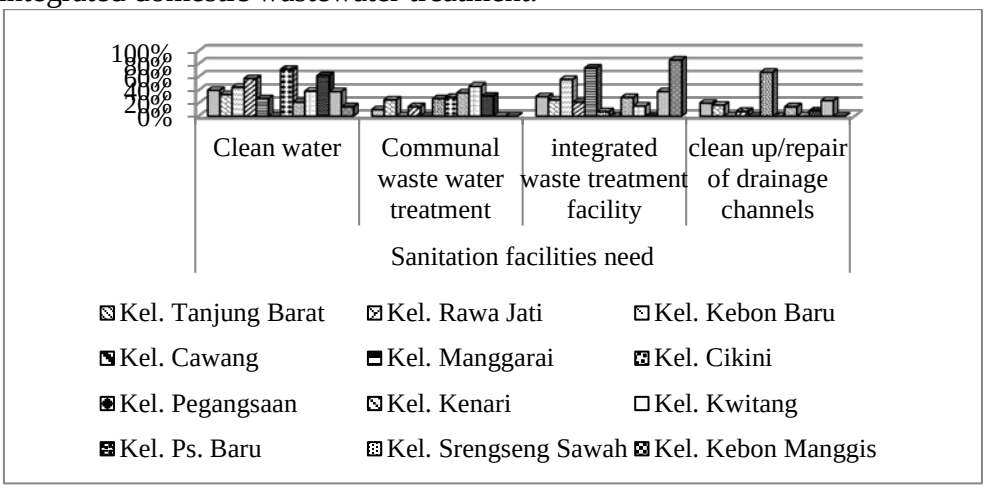

Figure 1 The purposes of sanitation facilities in 12 villages around Ciliwung River
Source: Jakarta Environmental Management Agency, 2011

In Regulation Governor of Jakarta Number 122 Year 2005 about Domestic Wastewater Management in Jakarta, Article 7 (1) Residential buildings and non-residential buildings are required to manage domestic wastewater before discharge into public channels/drainage. Article 15, in the activities of domestic wastewater treatment, community shall take a part to development the installation of domestic wastewater treatment.

Perception and public participation will play a role to make decisions in urban sanitation, livelihood development, improving food security, resource mobilization and encourage independence. Perception and public participation is crucial to the success of the project (Ghosh, 1999). Some activities by community related the sanitation program in Jakarta are cleaning up the environment, eradication of mosquito breeding, monitoring of environmental hygiene, clean and repair the drainage, composting and planting.

The factors that cause the community accepted that domestic wastewater must be treated by communal waste water treatment plant to support community-based sanitation program at the national level, are (1) They are already know and aware of tendency of environmental degradation, especially water quality due to waste water from settlements, (2) had a relevant regulations to manage the wastewater from settlements , (3) Has the sanitation activities in neighborhood and actively running the

program, (4) Obtain information about waste treatment unit with ecotechnology concept, simple to operate and inexpensive, (5) Understand that there will be a benefit directly or indirectly from the increased hygiene environment, and (6) the high cooperation among residents who are supporting the potential for wastewater management in the region. It also describes have an awareness and understanding of sanitation to improve the quality of the environment and quality of life.

Conclusion

Centralized Wastewater Treatment Plant (WWTP) in Jakarta, Bandung and Cirebon were built as an effort to support the city's sanitation. The performance efficiency of WWTP reached 80% and the treated wastewater is accordance with quality standard. But the WWTP in the three cities only can serve <20% of the population. So that untreated domestic wastewater will contaminate the natural waters.

The existence of regulations on the control of domestic wastewater and has a community-based sanitation programs to drive the implementation of communal waste water treatment program. Community already aware of the need to treat domestic wastewater as an effort to maintain environmental sanitation. Community expects a communal wastewater treatment.

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